Center Innovation Fund: GSFC CIF

Enhancing Sensitivity by Integrating A Custom Front End Electronics with Nanosensors Printed Using 3D Manufacturing Techniques

Completed Technology Project (2017 - 2018)

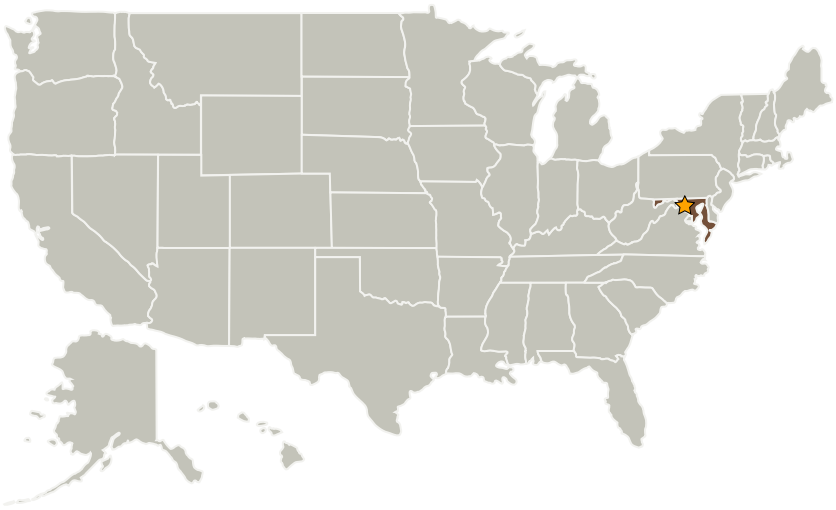
Project Introduction

The innovative aspects of this concept include the use of a novel offset printing technique that allows 3-D printing of different materials, including low dimensional materials such as graphene, carbon nanotube, and molybdenum disulfide. Device structures as small as tens of nanometer resolution can be printed directly on a single daughterboard. This process significantly simplifies the tedious fabrication process of nanosensors. It also eliminates the integration and packaging challenges associated fabricating individual sensors and then integrating them. In addition, the printing process is automated and can be used to address reproducibility and repeatability challenges typically faced with nanosensors. Key goals are to characterize the sensor performance using ammonia, hydrogen and methane, and complete data analysis and modeling by the end of the fiscal year.

Anticipated Benefits

This technology will allow much smaller sensors for detecting specific gases in planetary atmospheres, thus saving mass and perhaps enabling new scientific approaches.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
★Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland
Northeastern University(NEU)	Supporting Organization	Academia	Boston, Massachusetts

Primary U.S. Work Locations
Maryland

Project Transitions

October 2017: Project Start

September 2018: Closed out

Closeout Summary: This CIF addresses the need for low-power, small, light, and highly sensitive sensors that can detect species to fingerprint various biological and abiotic processes on outer planetary bodies. In collaboration with the Businaina group at Northeastern University (NEU), the team developed offset-printing techniques to print nanomaterials-based gas sensors. In addition, it also developed the front-end electronics to read out these sensors. Finally, the team characterized the response of these sensors with target gases. The effort is a step toward developing a multifunctional sensor platform that can detect a wide array of gases, as well as other environmental parameters.

Project Website:

https://www.nasa.gov/directorates/spacetech/innovation_fund/index.html#.VQ

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

Center Innovation Fund: GSFC CIF

Project Management

Program Director:

Michael R Lapointe

Program Manager:

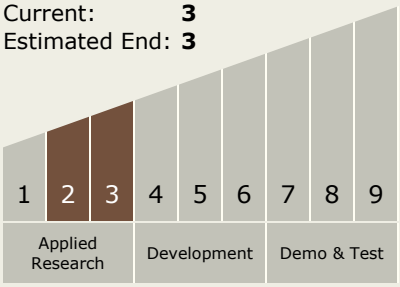
Peter M Hughes

Principal Investigator:

Mahmooda Sultana

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



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Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.4 Manufacturing
    - TX12.4.2 Intelligent Integrated Manufacturing

Target Destinations

Earth, Others Inside the Solar System, Outside the Solar System